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BASIC INSTRUCTIONS

Command	Abbreviation/Example	Comment
COMMANDS		
BYE	B.	Goes to the Memo Pad mode.
CLR	CLR	Clears all variables.
CONT	CON.	Continues execution.
DIM	DI. A$(30)	Reserves 30 bytes for A$.
	DI. B(17,3)	Defines an array 18 rows by 4 columns.
END	END	Closes files, turns off sound.
LET	LE.	Defines a variable.
LIST	L.	Lists a program.
	L. 400,500	Lists program lines 400 through 500.
NEW	NEW	Erases a program and variables.
POKE	POKE Y,X	Writes value X to memory addr Y.
REM	R.	Comment.
RUN	RU.	Begins execution of a program.
STOP	STO.	Halts execution without closing files.
PROGRAM STATEMENTS		
FOR, TO STOP/NEXT	F. X=3 TO 9 STEP 2 N, x	3,9,2 may be arithmetic expressions.
GOSUB RETURN	100 GOS. 300: ____ 300 ? 400 RET.	RETURN goes to the statement following the colon.
GOTO	G. X	X may be a variable or line number.
IF/THEN	IF Y=5 THEN 500 IF X then Y=6	Conditional branch. X=1 is false, X>0 is true. False goes to the next line number.
ON/GOSUB	ON X GOSUB 20,30,40 ON/GOTO	If X<1 or X>3, it goes to the next numbered line.
POP	POP	Use when RETURN is bypassed.
TRAP	T. 200	Identifies the line to GOTO in the event of an error.
I/O COMMANDS		
CLOAD	CLOA.	Loads a program from cassette.
CLOSE	C. #2	Closes a file.
CSAVE	CS.	Saves a program to cassette.
DOS	DO.	Displays the DOS menu.
ENTER	E. "D1:MYPROG	Loads a program. Used with LIST.
INPUT	I. Y$	Receives data from the keyboard.
LIST	L. "D1:MYPROG	Lists a program to a dataset.
LOAD	LO. "D1:MYPROG	Loads a program. Used with SAVE.
LPRINT	LP. X	Prints to a line printer.
NOTE	NO. #2,A,B	Detects the sector, byte within a file.
OPEN	O. #2,4,0,"D1:FILE	Open for 4=input 6=directory 8=output 9=append 12=I/O
POINT	P. #3,A,B	Position on sector A, byte B within a file.
PRINT	? A,B;"HERE"	Comma tabs, semicolon appends.
PUT/GET	PU. #6,ASC("L") GE. #5,Y	Output a single byte. Input a single byte.
READ	REA. A,B	Assign data values.
DATA	D. 5,10,16,3	Holds data values.
RESTORE	RES.350	350 is the line number of the data for the next READ.
SAVE	S. "D1:MYPROG	Saves a program. Used with LOAD.
STATUS	ST. #3,A	Sets A to the device status value
XIO	XIO cmdno,#5,aux1, aux2,"S:"	See XIO COMMAND CODES.

BASIC INSTRUCTIONS *continued*

Command	Abbreviation/Example	Comment
ARITHEMETIC FUNCTIONS		
ABS	Y=ABS(X)	Absolute value.
CLOG	Y=CLOG(X)	Base 10 logarithm.
EXP	Y=EXP(X)	Inverse of LOG. Y=e * * X.
INT	Y=INT(X)	Integer rounds down (-4.5 to -5).
LOG	Y=LOG(X)	Natural logarithm (E=2.71…).
RND	Y=RND(X)	Random number between 0 and 1.
SGN	Y=SGN(X)	Evaluates sign. Y=-1,0,+1.
SQR	Y-SQR(X)	Square root.
TRIG FUNCTIONS		*(others are derived)*
ATN	Y=ATN(X)	Inverse tangent.
COS	Y=COS(X)	Cosine.
SIN	Y=SIN(X)	Sine.
DEG/RAD	DEG	Degrees or radians.
SPECIAL FUNCTIONS		
ADR	Y=ADR(X$)	Memory address of a string.
FRE	? FRE(0)	Remaining free space in RAM.
PEEK	Y=PEEK(X)	Contents of memory at address X.
USR	Y=USR(X)	Result of machine language program at memory address X.
STRING FUNCTIONS		
ASC	Y=ASC(X$)	ATASCII of first byte of X$.
CHR$	Y$=CHR$(X)	Character with ATASCII value X.
LEN	Y=LEN(X$)	Length of a string.
STR$	Y$=STR$(X)	Defines a string.
VAL	Y=VAL(X$)	Evaluates a string.
substring	Y$=X$(5,8)	Y$ contains the fifth through the eighth character of X$.
GRAPHIC/SOUND		*(X increases to the right, Y increases down)*
GET	GE. #6,A	Inputs data from the screen.
GRAPHICS	GR. M	Graphics mode.
COLOR	C. 3	Color number for PLOT or DR.
DRAWTO	DR. X,Y	Draws to a screen coordinate.
LOCATE	LOC. X,Y,A	Sets A to the COLOR number of screen coordinate X,Y.
PLOT	PL. X,Y	Plots a graphic point.
POSITION	POS. X,Y	Positions cursor.
PUT	PU. #6,A	Outputs data to the screen.
SETCOLOR	SE. 1,2,4	Color register, hue, luminance.
SOUND	SO. 1,100,10,4	Voice (0-3), pitch (0-255), distortion (0-14 even), volume (0-15).
XIO	X. 18,#6,0,0,"S:"	XIO FILL from memory location 765.
CONTROLLER FUNCTIONS		
PADDLE	Y=PADDLE(X)	400/800: X=0 to 7, Y=0 to 228 XLs: X=1 to 3, Y=0 to 228
PTRIG	Y=PTRIG(X)	400/800: X=0 to 7, Y=0 (trig pressed) Y=1 (not pressed) XLs: X=0 to 3, Y=0 (trig pressed) Y=1 (not pressed)
STICK	Y=STICK(X)	400/800: X=0 to 3, Y=see JOYSTICK XLs: X=0 or 1, Y=see JOYSTICK
STRIG	Y=STRIG(X)	400/800: X=0 to 3, Y=0 (trig pressed) Y=1 (not pressed) XLs: X=0 or 1, Y=0 (trig pressed) Y=1 (not pressed)

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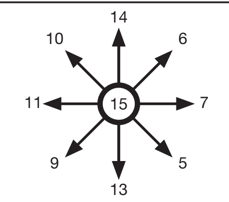
XIO COMMAND CODES

Code	Operation	Code	Operation
3	OPEN	18	FILL
5	GET RECORD	32	RENAME
7	GET CHARACTERS	33	DELETE
8	PUT RECORD	35	LOCK FILE
11	PUT CHARACTERS	36	UNLOCK FILE
12	CLOSE	37	POINT
13	STATUS REQUEST	38	NOTE
17	DRAW LINE	254	FORMAT

JOYSTICK MOVEMENT *(STICK values)*



SOUND COMMAND PITCH VALUES

Octave	-3	-2	-1	0	+1	+2	+3
Distort	12	12	10	10	10	10	10
B	67	33	128	64	31		
A#	72	36	136	68	33	16	
A	75	37	144	72	35		
G#	82	40	153	76	37	18	
G	85	42	162	81	40		
F#	90	45	173	85	42		
F	98	48	182	91	45		
E	102	51	193	96	47	23	
D#		55	204	102	50		
D		57	217	108	53	26	
C#		60	230	114	57		
C		63	243	121	60	29	14

The C in octave 0 is Midde C.

PLAYER/MISSLE AREA LAYOUT

Double Line Resolution		Single Line Resolution	
PMBASE Mult. of 1024		**PMBASE Mult. of 2048**	
PMBASE +384	MISSILES	PMBASE +768	MISSILES
PMBASE +512	PLAYER 0	PMBASE +1024	PLAYER 0
PMBASE +640	PLAYER 1	PMBASE +1280	PLAYER 1
PMBASE +768	PLAYER 2	PMBASE +1536	PLAYER 2
PMBASE +896	PLAYER 3	PMBASE +1792	PLAYER 3
PMBASE +1024		PMBASE +2048	

SYMBOLIC DEVICE NAMES

Symbol	Device	I/O	IOCB
C:	Cassette Tape Unit	I/O	#7
D:	Same as D1:	I/O	
D1:, D2:, D3:, D4:	Disk Units 1-4	I/O	
E:	Screen Editor	I/O	#0
K:	Keyboard	I	
P:	Printer	O	
R:	RS-232 Interface	I/O	
S:	Screen	I/O	#6

6502 ASSEMBLER LANGUAGE MNEMONICS

Code	Operation
ADC	Add memory to accumulator with carry.
AND	AND memory with accumulator.
ASL	Shift left one bit.
BCC	Branch on carry clear.
BCS	Branch on carry set.
BEQ	Branch on result zero.
BIT	Test bits in accumulator with memory.
BMI	Branch on result minus.
BNE	Branch on result not zero.
BPL	Branch on result plus.
BRK	Force break.
BVC	Branch on overflow clear.
BVS	Branch on overflow set.
CLC	Clear carry flag.
CLD	Clear decimal mode.
CLI	Clear interrupt disable flag.
CLV	Clear overflow tag.
CMP	Compare memory and accumulator.
CPX	Compare memory and index X.
CPY	Compare memory and index Y.
DEC	Decrement memory by one.
DEX	Decrement index X by one.
DEY	Decrement index Y by one.
EOR	Exclusive OR memory with accumulator.
INC	Increment memory by one.
INX	Increment index X by one.
INY	Increment index Y by one.
JMP	Jump to new location.
JSR	Jump to new location, save return address.
LDA	Load accumulator from memory.
LDX	Load index X from memory.
LDY	Load index Y from memory.
LSR	Shift right one bit.
NOP	No operation.
ORA	OR memory with accumulator.
PHA	Push accumulator on stack.
PHP	Push processor status on stack.
PLA	Pull accumulator from stack.
PLP	Pull processor status from stack.
ROL	Rotate one bit left.
ROR	Rotate one bit right.
RTI	Return from interrupt.
RTS	Return from subroutine.
SBC	Subtract memory and borrow from accumulator.
SEC	Set carry flag.
SED	Set decimal mode.
SEI	Set interrupt disable flag.
STA	Store accumulator in memory.
STX	Store index X in memory.
STY	Store index Y in memory.
TAX	Transfer accumulator to index X.
TAY	Transfer accumulator to index Y.
TSX	Transfer stack pointer to index X.
TXA	Transfer index X to accumulator.
TXS	Transfer index X to stack pointer.
TYA	Transfer index Y to accumulator.

PEEK/POKE ADDRESSES *frequently used*

Label	Decimal	Hex	R	Description
RTCLOCK	18-20	12-14		TV frame counter (LSB-MSB).
ATTRACT	77	4D		Zero to suppress the attract mode.
LMARGIN	82	52		Left screen margin. Default 2.
RMARGIN	83	53		Right screen margin. Default 39.
GRMODE	87	57		Graphic mode number.
RAMTOP	106	6A		Top of RAM in pages.
STARP	140-1	8C-D		Points to the string array table.
STOPLN	186-7	BA-B		Line number of STOP or TRAP.
ERRSAV	195	C3		Error number.
FRO	212-3	D4-5		Value returned by USR (LSB-MSB).
SDMCTL	559	022F		Shadow for Direct Memory Access CTL Register. Playfield size: 1=narrow, 2=standard, 3=wide. Missile DMA=4, player DMA=8. Player resolution: 0=double line, 16=single line, DMA enable=32 (this bit must be on).
SDLSTL	560-1	0230-1		Points to the display list (LSM-MSB)
GPRIOR	623	026F		P/M priority: 1 = P0-3, PFO-3, BAK 2 = P0-1, PFO-2, P2-3, BAK 4 = PFO-3, P0-3, BAK 8 = PFO, PF1, P0-P3, PF2-3, BAK 16 = 5th player 32 = 3rd color
TXTROW	656	0290		Text cursor row.
TXTCOL	657-8	0291-2		Text cursor column.
PCOLR0	704	02C0		Color of player/missile 0.
PCOLR1	705	02C1		Color of player/missile 1.
PCOLR2	706	02C2		Color of player/missile 2.
PCOLR3	707	02C3		Color of player/missile 3.
PF0	708	02C4		Color register 0.
PF1	709	02C5		Color register 1.
PF2	710	02C6		Color register 2.
PF3	711	02C7		Color register 3.
BAK	712	02C8		Color register 4.
CRSINH	752	02F0		Cursor inhibit – 0=cursor on, 1=off
CHBAS	756	02F4		Character base register.
CH	764	02FC		Internal code of the last key pressed.
HPOSP0	53248	D000	W	Horizontal position of player 0.
M0PF			R	Missile 0/playfield collision.
HPOSP1	53249	D001	W	Horizontal position of player 1.
M1PF			R	Missile 1/playfield collision.
HPOSP2	53250	D002	W	Horizontal position of player 2.
M2PF			R	Missile 2/playfield collision.
HPOSP3	53251	D003	W	Horizontal position of player 3.
M3PF			R	Missile 3/playfield collision.
HPOSM0	53252	D004	W	Horizontal position of missile 0.
P0PF			R	Player 0/playfield collision.
HPOSM1	53253	D005	W	Horizontal position of missile 1.
P1PF			R	Player 1/playfield collision.
HPOSM2	53254	D006	W	Horizontal position of missile 2.
P2PF			R	Player 2/playfield collision.
HPOSM3	53255	D007	W	Horizontal position of missile 3.
P3PF			R	Player 3/playfield collision.
SIZEP0	53256	D008	W	Size of player 0. 1=2X, 3=4X.
M0PL			R	Missile 0 to player collision.
SIZE10	53257	D009	W	Size of player 1. 1=2X, 3=4X.
M1PL			R	Missile 1 to player collision.
SIZEP2	53258	D00A	W	Size of player 2. 1=2X, 3=4X.
M2PL			R	Missile 2 to player collision.
SIZEP3	53259	D00B	W	Size of player 3. 1= 2X, 3=4X.
M3PL			R	Missile 3 to player collision.

PEEK/POKE ADDRESSES *frequently used, continued*

Label	Decimal	Hex	R	Description
SIZEM	53260	D00C	W	Missile size. 1=2X, 3=4X
P0PL			R	Player 0 to player collision.
P1PL	53261	D00D	R	Player 1 to player collision.
P2PL	53262	D00E	R	Player 2 to player collision.
P3PL	53263	D00F	R	Player 3 to player collision.
GRACTL	53277	D01D	W	1=Missile DMA, 2=Player DMA
HITCLR	53278	D01E	W	Any number clears collision registers.
PMBASE	54279	D407	W	Player missile base address.
WSYNC	54282	D40A	W	Wait for horizontal sync.
VCOUNT	54283	D40B	R	Vertical TV scan line counter.
NMIEN	54286	D40E	W	Non-maskable interrupt enable (192 for DLI).

ERROR MESSAGES

Code	Message
2	Insufficient memory for a statement, variable, or DIM.
3	A value is outside its expected range.
4	More than 128 variables have been defined.
5	A string exceeded its dimensioned length.
6	A READ occurred for which there was no DATA.
7	A value is not a positive interger or exceeds 32767.
8	Attempted to INPUT a non-numeric value into a variable which is not a dimensioned string.
9	DIM size exceeds 32767, or a subscript exceeds the dimensioned size of the array, or the array or string has already been dimensioned, or was never dimensioned.
10	Too many nested GOSUBs. The argument stack has overflowed.
11	Floating point under/overflow. Attempted to divide by zero or refer to a number less than 10^{-99} or greater than 10^{98}.
12	The referenced line number does not exist.
13	NEXT with no corresponding FOR.
14	The statement is too long or too complex.
15	NEXT or RETURN relates to a FOR or GOSUB which has been deleted.
16	RETURN with no corresponding GOSUB.
17	An invalid machine instruction or address was encountered.
18	A string begins with an invalid value, or a VAL string is not numeric.
19	Insufficient memory to load the program.
20	Invalid device number.
21	Attempted to LOAD a non-LOAD file.
128	A BREAK occurred during I/O.
129	The IOCB is already open.
130	The specified device does not exist.
131	READ attempted to a write-only device.
132	Invalid I/O command.
133	The file or device is not OPEN.
134	Invalid IOCB number.
135	WRITE attempted to a read-only device.
136	End of file.
137	Attempted to read a record longer than 256.
138	Device did not respond to the I/O commands.
139	I/O error or fauly disk drive.
140	Serial bus input framing error.
141	Cursor exceeded the range of the graphics mode.
142	Serial bus data frame overrun.
143	Serial bus data frame checksum error.
144	Attempted to write to a write-protected disk.

ERROR MESSAGES *continued*

Code	Message
145	Read after write compare error.
146	Function not implemented in handler.
147	Insufficient memory for the selected graphics mode.
160	Drive number error.
161	Too many files are OPEN.
162	No more free space on disk.
163	Unrecoverable system data I/O error.
164	File number mismatch.
165	Filename error.
166	POINT data length error.
167	File is locked.
168	Invalid or privileged instruction.
169	Disk volume-table-of-contents (VTOC) is full (64 files).
170	File not found.
171	POINT invalid.

COLOR REGISTER VALUES

Color	Setcolor Hue	Add-Value	Color	Setcolor Hue	Add-Value
black	0	0	medium blue	8	128
rust	1	16	dark blue	9	144
red-orange	2	32	blue-gray	10	160
dark orange	3	48	olive green	11	176
red	4	64	medium green	12	192
dark lavender	5	80	dark green	13	208
cobalt blue	6	96	orange-green	14	224
ultramarine blue	7	112	orange	15	240

For SETCOLOR A,B,C the contents of
Color Reg A = (ADD-VALUE of B) + C
= (B * 16) + C

REFERENCE CARD LEGENDS & ABBREVIATIONS

Legend	Description
CODE TRANSLATION TABLE	
Dec	Decimal number.
Hex	Hexadecimal.
Chars	ATASCII display and control ch aracters.
Int.	Internal keyboard code: PEEK(764)
aec	Control keys pressed: ATARI, ESCAPE, CNTL/SHIFT
Key.	Keyboard key cap.
Asm	6502 Assembler mnemonic.
Addr Mode.	Machine language address mode abbreviations: ABS=absolute, PG=page, IDX=indexed, INDIR=indirect, ACCUM=accumulator, IMMED=immediate
CONTROL CHARACTER DISPLAY	
ASC	ATASCII.
aec	Control keys pressed: ATARI, ESCAPE, CNTL/SHIFT
Key.	Keyboard key cap.
Display	Vertical lines bounding this column indicate reverse video.
DEFAULT CHARACTER SET	
CH#	The relative character number within the set.
REG 0-3	Playfield color registers 0 through 3.
ASC	ATASCII.
aec	Control keys pressed: ATARI, ESCAPE, CNTL/SHIFT
Key.	Keyboard key cap.
FREQUENTLY USED PEEK/POKE ADDRESSES	
R, W.	Read-only or write-only.

CODE TRANSLATION TABLE

Dec	Hex	Chars	Int.	aec	Key	Asm	Addr Mode
0	00	♥	160	c	,	BRK	IMPLIED
1	01	┣	191	c	A	ORA	IDX INDIR
2	02	▕	149	c	B		
3	03	┛	146	c	C		
4	04	┫	186	c	D		
5	05	┓	170	c	E	ORA	ZERO PG
6	06	╱	184	c	F	ASL	ZERO PG
7	07	╲	189	c	G		
8	08	◢	185	c	H	PHP	IMPLIED
9	09	▗	141	c	I	ORA	IMMED
10	0A	◣	129	c	J	ASL	ACCUM
11	0B	▝	133	c	K		
12	0C	▘	128	c	L		
13	0D	▔	165	c	M	ORA	ABS
14	0E	▁	163	c	N	ASL	ABS
15	0F	▖	136	c	O		
16	10	♣	138	c	P	BPL	RELATIVE
17	11	┏	175	c	Q	ORA	INDIR IDX
18	12	━	168	c	R		
19	13	╋	190	c	S		
20	14	●	173	c	T		
21	15	▄	139	c	U	ORA	ZERO PG X
22	16	▎	144	c	V	ASL	ZERO PG X
23	17	┳	174	c	W		
24	18	┻	150	c	X	CLC	IMPLIED
25	19	▌	171	c	Y	ORA	ABS Y
26	1A	┗	151	c	Z		
27	1B	ESC	28		ESC		
28	1C	↑	142	c	-		
29	1D	↓	143	c	=	ORA	ABS X
30	1E	←	134	c	+	ASL	ABS X
31	1F	→	135	c	*		
32	20		33		SPC	JSR	ABS
33	21	!	95		!	AND	IDX INDIR
34	22	"	94		"		
35	23	#	90		#		
36	24	$	88		$	BIT	ZERO PG
37	25	%	93		%	AND	ZERO PG
38	26	&	91		&	ROL	ZERO PG
39	27	'	115		'		
40	28	(	112		(	PLP	IMPLIED
41	29	)	114		)	AND	IMMED
42	2A	*	7		*	ROL	ACCUM
43	2B	+	6		+		
44	2C	,	32		,	BIT	ABS
45	2D	-	14		-	AND	ABS
46	2E	.	34		.	ROL	ABS
47	2F	/	38		/		
48	30	0	50		0	BMI	RELATIVE
49	31	1	31		1	AND	INDIR IDX
50	32	2	30		2		
51	33	3	26		3		
52	34	4	24		4		
53	35	5	29		5	AND	ZERO PG X
54	36	6	27		6	ROL	ZERO PG X
55	37	7	51		7		
56	38	8	53		8	SEC	IMPLIED
57	39	9	48		9	AND	ABS Y
58	3A	:	66		:		
59	3B	;	2		;		
60	3C	<	54		<		
61	3D	=	15		=	AND	ABS X
62	3E	>	55		>	ROL	ABS X
63	3F	?	102		?		
64	40	@	117		@	RTI	IMPLIED
65	41	A	63		A	EOR	IDX INDIR
66	42	B	21		B		
67	43	C	18		C		
68	44	D	58		D		
69	45	E	42		E	EOR	ZERO PG
70	46	F	56		F	LSR	ZERO PG
71	47	G	61		G		
72	48	H	57		H	PHA	IMPLIED
73	49	I	13		I	EOR	IMMED
74	4A	J	1		J	LSR	ACCUM
75	4B	K	5		K		
76	4C	L	0		L	JMP	ABS
77	4D	M	37		M	EOR	ABS
78	4E	N	35		N	LSR	ABS
79	4F	O	8		O		
80	50	P	10		P	BVC	RELATIVE
81	51	Q	47		Q	EOR	INDIR IDX
82	52	R	40		R		
83	53	S	62		S		
84	54	T	45		T		
85	55	U	11		U	EOR	ZERO PG X
86	56	V	16		V	LSR	ZERO PG X
87	57	W	46		W		
88	58	X	22		X	CLI	IMPLIED
89	59	Y	43		Y	EOR	ABS Y
90	5A	Z	23		Z		
91	5B	[	96		[		
92	5C	\	70		\		
93	5D	]	98		]	EOR	ABS X
94	5E	^	71		^	LSR	ABS X
95	5F	_	78		_		
96	60	♦	162	c	.	RTS	IMPLIED
97	61	a	63		a	ADC	IDX INDIR
98	62	b	21		b		
99	63	c	18		c		
100	64	d	58		d		
101	65	e	42		e	ADC	ZERO PG
102	66	f	56		f	ROR	ZERO PG
103	67	g	61		g		
104	68	h	57		h	PLA	IMPLIED
105	69	i	13		i	ADC	IMMED
106	6A	j	1		j	ROR	ACCUM
107	6B	k	5		k		
108	6C	l	0		l	JMP	INDIRECT
109	6D	m	37		m	ADC	ABS
110	6E	n	35		n	ROR	ABS
111	6F	o	8		o		
112	70	p	10		p	BVS	RELATIVE
113	71	q	47		q	ADC	INDIR IDX
114	72	r	40		r		
115	73	s	62		s		
116	74	t	45		t		
117	75	u	11		u	ADC	ZERO PG X
118	76	v	16		v	ROR	ZERO PG X
119	77	w	46		w		
120	78	x	22		x	SEI	IMPLIED
121	79	y	43		y	ADC	ABS Y
122	7A	z	23		z		
123	7B	♠	130	c	;		
124	7C	|	79		|		
125	7D	CLEAR	118	s	CLR	ADC	ABS X
126	7E	BKSPAC	52		DEL	ROR	ABS X
127	7F	TAB	44		TAB		
128	80	♥	96	a c	,		
129	81	┣	191	a c	A	STA	IDX INDIR
130	82	▕	149	a c	B		
131	83	┛	146	a c	C		
132	84	┫	186	a c	D	STY	ZERO PG
133	85	┓	170	a c	E	STA	ZERO PG
134	86	╱	184	a c	F	STX	ZERO PG
135	87	╲	189	a c	G		
136	88	◢	185	a c	H	DEY	IMPLIED
137	89	▗	141	a c	I		
138	8A	◣	129	a c	J	TXA	IMPLIED
139	8B	▝	133	a c	K		
140	8C	▘	128	a c	L	STY	ABS
141	8D	▔	165	a c	M	STA	ABS
142	8E	▁	163	a c	N	STX	ABS
143	8F	▖	136	a c	O		
144	90	♣	138	a c	P	BCC	RELATIVE
145	91	┏	175	a c	Q	STA	INDIR IDX
146	92	━	168	a c	R		
147	93	╋	190	a c	S		
148	94	●	173	a c	T	STY	ZERO PG X
149	95	▄	139	a c	U	STA	ZERO PG X
150	96	▎	144	a c	V	STX	ZERO PG Y
151	97	┳	174	a c	W		
152	98	┻	150	a c	X	TYA	IMPLIED
153	99	▌	171	a c	Y	STA	ABS Y
154	9A	┗	151	a c	Z	TXS	IMPLIED
155	9B	RETURN	12		RTN		
156	9C	↑	116	s	DEL		
157	9D	↓	119	s	INS	STA	ABS X
158	9E	←	172	c	TAB		
159	9F	→	108	s	TAB		
160	A0	█	33	a	SPC	LDY	IMMED
161	A1	!	95	a	!	LDA	IDX INDIR
162	A2	"	94	a	"	LDX	IMMED
163	A3	#	90	a	#		
164	A4	$	88	a	$	LDY	ZERO PG
165	A5	%	93	a	%	LDA	ZERO PG
166	A6	&	91	a	&	LDX	ZERO PG
167	A7	'	115	a	'		
168	A8	(	112	a	(	TAY	IMPLIED
169	A9	)	114	a	)	LDA	IMMED
170	AA	*	7	a	*	TAX	IMPLIED
171	AB	+	6	a	+		
172	AC	,	32	a	,	LDY	ABS
173	AD	-	14	a	-	LDA	ABS
174	AE	.	34	a	.	LDX	ABS
175	AF	/	38	a	/		
176	B0	0	50	a	0	BCS	RELATIVE
177	B1	1	31	a	1	LDA	INDIR IDX
178	B2	2	30	a	2		
179	B3	3	26	a	3		
180	B4	4	24	a	4	LDY	ZERO PG X
181	B5	5	29	a	5	LDA	ZERO PG X
182	B6	6	27	a	6	LDX	ZERO PG X
183	B7	7	51	a	7		ZERO PG Y
184	B8	8	53	a	8	CLV	IMPLIED
185	B9	9	48	a	9	LDA	ABS Y
186	BA	:	66	a	:	TSX	IMPLIED
187	BB	;	2	a	;		
188	BC	<	54	a	<	LDY	ABS X
189	BD	=	15	a	=	LDA	ABS X
190	BE	>	55	a	>	LDX	ABS Y
191	BF	?	102	a	?		
192	C0	@	117	a	@	CPY	IMMED
193	C1	A	63	a	A	CMP	IDX INDIR
194	C2	B	21	a	B		
195	C3	C	18	a	C		
196	C4	D	58	a	D	CPY	ZERO PG
197	C5	E	42	a	E	CMP	ZERO PG
198	C6	F	56	a	F	DEC	ZERP PG
199	C7	G	61	a	G		
200	C8	H	57	a	H	INY	IMPLIED
201	C9	I	13	a	I	CMP	IMMED
202	CA	J	1	a	J	DEX	IMPLIED
203	CB	K	5	a	K		
204	CC	L	0	a	L	CPY	ABS
205	CD	M	37	a	M	CMP	ABS
206	CE	N	35	a	N	DEC	ABS
207	CF	O	8	a	O		
208	D0	P	10	a	P	BNE	RELATIVE
209	D1	Q	47	a	Q	CMP	INDIR IDX
210	D2	R	40	a	R		
211	D3	S	62	a	S		
212	D4	T	45	a	T		
213	D5	U	11	a	U	CMP	ZERO PG X
214	D6	V	16	a	V	DEC	ZERO PG X
215	D7	W	46	a	W		
216	D8	X	22	a	X	CLD	IMPLIED
217	D9	Y	43	a	Y	CMP	ABS Y
218	DA	Z	24	a	Z		
219	DB	[	96	a	[		
220	DC	\	70	a	\		
221	DD	]	98	a	]	CMP	ABS X
222	DE	^	71	a	^	DEC	ABS X
223	DF	_	78	a	_		
224	E0	♦	162	a c	.	CPX	IMMED
225	E1	a	63	a	a	SBC	IDX INDIR
226	E2	b	21	a	b		
227	E3	c	18	a	c		
228	E4	d	58	a	d	CPX	ZERO PG
229	E5	e	42	a	e	SBC	ZERO PG
230	E6	f	56	a	f	INC	ZERO PG
231	E7	g	61	a	g		
232	E8	h	57	a	h	INX	IMPLIED
233	E9	i	13	a	i	SBC	IMMED
234	EA	j	1	a	j	NOP	IMPLIED
235	EB	k	5	a	k		
236	EC	l	0	a	l	CPX	ABS
237	ED	m	37	a	m	SBC	ABS
238	EE	n	35	a	n	INC	ABS
239	EF	o	8	a	o		
240	F0	p	10	a	p	BEQ	RELATIVE
241	F1	q	47	a	q	SBC	INDIR IDX
242	F2	r	40	a	r		
243	F3	s	62	a	s		
244	F4	t	45	a	t		
245	F5	u	11	a	u	SBC	ZERO PG X
246	F6	v	16	a	v	INC	ZERO PG X
247	F7	w	46	a	w		
248	F8	x	22	a	x	SED	IMPLIED
249	F9	y	43	a	y	SBC	ABS Y
250	FA	z	23	a	z		
251	FB	♠	130	a c	;		
252	FC	|	79	a	|		
253	FD	↖	158	c	2	SBC	ABS X
254	FE	◀	180	c	DEL	INC	ABS X
255	FF	▶	183	c	INS		

KEYBOARD INTERNAL CODES *PEEK(764)*

Key Cap	Normal	SHIFT	CNTL	SHIFT CNTL	Key Cap	Normal	SHIFT	CNTL	SHIFT CNTL
A	63	127	191	255	0	50	114	178	242
B	21	85	149	213	1	31	95	159	223
C	18	82	146	210	2	30	94	158	222
D	58	122	186	250	3	26	90	154	218
E	42	106	170	234	4	24	88	152	216
F	56	120	184	248	5	29	93	157	221
G	61	125	189	253	6	27	91	155	219
H	57	121	185	249	7	51	115	179	243
I	13	77	141	205	8	53	117	181	245
J	1	65	129	193	9	48	112	176	240
K	5	69	133	197	+	6	70	134	198
L	0	64	128	192	-	14	78	142	206
M	37	101	165	229	*	7	71	135	199
N	35	99	163	227	/	38	102	166	230
O	8	72	136	200	<	54	118	182	246
P	10	74	138	202	>	55	119	183	247
Q	47	111	175	239	=	15	79	143	207
R	40	104	168	232	.	34	98	162	226
S	62	126	190	254	,	32	96	160	224
T	45	109	173	237	;	2	66	130	194
U	11	75	139	203	ESC	28	92	156	220
V	16	80	144	208	BKSPAC	52	116	180	244
W	46	110	174	238	TAB	44	108	172	236
X	22	86	150	214	RETURN	12	76	140	204
Y	43	107	171	235	LOWER	60	124	188	252
Z	23	87	151	215	ATARI	39	103	167	231
					SPACE	33	97	161	225

HEXADECIMAL COLUMNS

4		3		2		1	
HEX =	Dec	Hex =	Dec	Hex =	Dec	Hex =	Dec
0	0	0	0	0	0	0	0
1	4096	1	256	1	16	1	1
2	8192	2	512	2	32	2	2
3	12288	3	768	3	48	3	3
4	16384	4	1024	4	64	4	4
5	20480	5	1280	5	80	5	5
6	24576	6	1536	6	96	6	6
7	28672	7	1792	7	112	7	7
8	32768	8	2048	8	128	8	8
9	36864	9	2304	9	144	9	9
A	40960	A	2560	A	160	A	10
B	45056	B	2816	B	176	B	11
C	49152	C	3072	C	192	C	12
D	53248	D	3328	D	208	D	13
E	57344	E	3584	E	224	E	14
F	61440	F	3840	F	240	F	15

DEFAULT CHARACTER SETS
1=POKE 756,224   2=POKE 756,226

DISPLAY			REG 0		REG 1			REG 2			REG 3		
CH#	1	2	ASC	KEY	ASC	AEC	KEY	ASC	AEC	KEY	ASC	AEC	KEY
0			32	SPC	0	c	,	160	a	SPC	128	a c	,
1	!		33	!	1	c	A	161	a	!	129	a c	A
2	"		34	"	2	c	B	162	a	"	130	a c	B
3	#		35	#	3	c	C	163	a	#	131	a c	C
4	$		36	$	4	c	D	164	a	$	132	a c	D
5	%		37	%	5	c	E	165	a	%	133	a c	E
6	&		38	&	6	c	F	166	a	&	134	a c	F
7	'		39	'	7	c	G	167	a	'	135	a c	G
8	(		40	(	8	c	H	168	a	(	136	a c	H
9	)		41	)	9	c	I	169	a	)	137	a c	I
10	*		42	*	10	c	J	170	a	*	138	a c	J
11	+		43	+	11	c	K	171	a	+	139	a c	K
12	,		44	,	12	c	L	172	a	,	140	a c	L
13	-		45	-	13	c	M	173	a	-	141	a c	M
14	.		46	.	14	c	N	174	a	.	142	a c	N
15	/		47	/	15	c	O	175	a	/	143	a c	O
16	0		48	0	16	c	P	176	a	0	144	a c	P
17	1		49	1	17	c	Q	177	a	1	145	a c	Q
18	2		50	2	18	c	R	178	a	2	146	a c	R
19	3		51	3	19	c	S	179	a	3	147	a c	S
20	4		52	4	20	c	T	180	a	4	148	a c	T
21	5		53	5	21	c	U	181	a	5	149	a c	U
22	6		54	6	22	c	V	182	a	6	150	a c	V
23	7		55	7	23	c	W	183	a	7	151	a c	W
24	8		56	8	24	c	X	184	a	8	152	a c	X
25	9		57	9	25	c	Y	185	a	9	153	a c	Y
26	:		58	:	26	c	Z	186	a	:	154	a c	Z
27	;		59	;	27	e	ESC	187	a	;	155		
28	<		60	<	28	ec	-	-188	a	<	156	es	DEL
29	=		61	=	29	ec	=	189	a	=	157	es	INS
30	>		62	>	30	ec	+	190	a	>	158	ec	TAB
31	?		63	?	31	ec	*	191	a	?	159	es	TAB
32	@		64	@	96	c	.	192	a	@	224	a c	.
33	A	a	65	A	97		a	193	a	A	225	a	a
34	B	b	66	B	98		b	194	a	B	226	a	b
35	C	c	67	C	99		c	195	a	C	227	a	c
36	D	d	68	D	100		d	196	a	D	228	a	d
37	E	e	69	E	101		e	197	a	E	229	a	e
38	F	f	70	F	102		f	198	a	F	230	a	f
39	G	g	71	G	103		g	199	a	G	231	a	g
40	H	h	72	H	104		h	200	a	H	232	a	h
41	I	i	73	I	105		i	201	a	I	233	a	i
42	J	j	74	J	106		j	202	a	J	234	a	j
43	K	k	75	K	107		k	203	a	K	235	a	k
44	L	l	76	L	108		l	204	a	L	236	a	l
45	M	m	77	M	109		m	205	a	M	237	a	m
46	N	n	78	N	110		n	206	a	N	238	a	n
47	O	o	79	O	111		o	207	a	O	239	a	o
48	P	p	80	P	112		p	208	a	P	240	a	p
49	Q	q	81	Q	113		q	209	a	Q	241	a	q
50	R	r	82	R	114		r	210	a	R	242	a	r
51	S	s	83	S	115		s	211	a	S	243	a	s
52	T	t	84	T	116		t	212	a	T	244	a	t
53	U	u	85	U	117		u	213	a	U	245	a	u
54	V	v	86	V	118		v	214	a	V	246	a	v
55	W	w	87	W	119		w	215	a	W	247	a	w
56	X	x	88	X	120		x	216	a	X	248	a	x
57	Y	y	89	Y	121		y	217	a	Y	249	a	y
58	Z	z	90	Z	122		z	218	a	Z	250	a	z
59	[		91	[	123	c	;	219	a	[	251	a c	;
60	\	|	92	\	124		|	220	a	\	252	a	|
61	]		93	]	125	es	CLR	221	a	]	253	ec	2
62	^	<<	94	^	126	e	DEL	222	a	^	254	ec	DEL
63	_	>>	95	_	127	e	TAB	223	a	_	255	ec	INS

GRAPHIC MODE SPECIFICATIONS

Basic GRAPHICS Mode	Internal Mode (Hex)	Mode Type	Screen Size (GR Points or Char)			GR Point Size		Bytes/ Line	Color Bits	Basic COLOR	Color Basic SETCOLOR	Bit Values	Color Register	Register Assignment	Total RAM Requirement		Char Set Size	Bytes/ Char Set
			Hor	Vert	Vert-split	Hor (clocks)	Vert (scans)								Full	Split		
0	2	TEXT	40	24		4	8	40	Bit 7	ATASCII Value	1 2 4		PF1 PF2 BAK	char luminance background; char color border	992		128	1024
1	6	TEXT	20	24	20	8	8	20	6 & 7	ATASCII Value	0 1 2 3 4	00 01 10 11	PF0 PF1 PF2 PF3 BAK	characters characters characters characters background/border	672	674	64	512
2	7	TEXT	20	12	10	8	16	20	6 & 7	ATASCII Value	0 1 2 3 4	00 01 10 11	PF0 PF1 PF2 PF3 BAK	characters characters characters characters background/border	420	424	64	512
3	8	GR	40	24	20	4	8	10	Bit Pairs	1 2 3 0	0 1 2 4	01 10 11 00	PF0 PF1 PF2 BAK	graphics point graphics point graphics point gr point/background	432	434		
4	9	GR	80	48	40	2	4	10	Single Bits	1 0	0 4	1 0	PF0 BAK	graphics point gr point/background	696	794		
5	A	GR	80	48	40	2	4	20	Bit Pairs	1 2 3 0	0 1 2 4	01 10 11 00	PF0 PF1 PF2 BAK	graphics point graphics point graphics point gr point/background	1176	1174		

GRAPHIC MODE SPECIFICATIONS *continued*

Basic GRAPHICS Mode	Internal Mode (Hex)	Mode Type	Screen Size (GR Points or Char)			GR Point Size		Bytes/ Line	Color Bits	Basic COLOR	Color Basic SETCOLOR	Bit Values	Color Register	Register Assignment	Total RAM Requirement		Char Set Size	Bytes/ Char Set
			Hor	Vert	Vert-split	Hor (clocks)	Vert (scans)								Full	Split		
6	B	GR	160	96	80	1	2	20	Single Bits	1 0	0 4	1 0	PF0 BAK	graphics point gr point/border/background	2184	2174		
7 (7+)	D E	GR GR	160 160	96 192	80 160	1 1	2 1	40 40	Bit Pairs	1 2 3 0	0 1 2 4	01 10 11 00	PF0 PF1 PF2 BAK	graphics point graphics point graphics point gr point/border/background	4200 8138	4190 8112		
8	F	GR	320	192	160	1/2	1	40	Single Bits	1 0	1 2 4	1 0	PF1 PF2 BAK	gr point luminance gr point/background border	8138	8112		
9	F	GR	80	192	NONE			40	4	0-15L					8138			
10	F	GR	80	192	NONE			40	4	0 1 2 3 4 5 6 7 8	POKE 704 POKE 705 POKE 706 POKE 707 0 1 2 3 4	0000 0001 0010 0011 0100 0101 0110 0111 1000	PM0 PM1 PM2 PM3 PF0 PF1 PF2 PF3 BAK	graphics point graphics point graphics point graphics point graphics point graphics point graphics point graphics point gr point/border/background	8138			
11	F	GR	80	192	NONE			40	4	0-15C					8138			